

# Health Risk Appraisal: Review of Evidence for Effectiveness

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*Since its introduction some two decades ago, health risk appraisal (HRA) has become a standard offering in the health promotion repertoire. The technique's distinctive feature is its use of epidemiologic data to generate quantitative risk messages for the client. Yet despite the dedication and considerable investments that have gone into HRA's development, dissemination, and use, there is only limited empirical evidence that these quantitative risk messages have any effect on clients. There do not appear to be any formal studies of HRA's effect on participation in health promotion programs, although increasing recruitment is regarded as a major benefit of using HRA. There are few indications of HRA effects on health beliefs. Most positive reports of effects on behavior change come from uncontrolled studies; several randomized controlled trials have yielded ambiguous findings. Virtually no data exist concerning the impact of the quantitative risk messages that distinguish HRA from other assessment techniques and that have motivated the substantial efforts toward developing and refining HRA. HRA has evident appeal and is probably a useful health education device for middle-class, middle-aged, nonminor-*

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*ity clients. It may well have desirable effects on health-related beliefs, attitudes, and behaviors when accompanied by counseling or education, but available evidence has not established its effectiveness. Given the difficulty of obtaining definitive evidence of the effectiveness of HRA and specifically of its use of quantitative risk projections, the need for such evidence is debatable. An adequately funded and reviewed research program to examine whether projections of absolute risk affect knowledge, beliefs, attitudes, and intention to change is recommended as the most fruitful next step. Epidemiologically based HRA procedures that provide feedback in terms of qualitative statements or relative risk may be a promising approach to prospective health assessment.*

Health risk appraisal (HRA—also called health risk assessment or health hazard appraisal) was formally introduced in 1970 with the publication of a manual by Robbins and Hall [1]. The procedure was part of an effort by several physicians to reorient medical practice from an overwhelmingly retrospective focus on existing illness toward a more prospective focus on reducing risks of future illness [2]. In line with the ongoing multifaceted movement toward health promotion and disease prevention, risk reduction has come to play a much greater role in medical practice. The HRA procedure itself, however, has been most widely adopted in health education and health promotion programs outside of clinical medicine, especially in worksites. Furthermore, amid the near-universal popular acceptance of concepts of disease prevention and health promotion, HRA and the Society for Prospective Medicine (the professional society founded by HRA's original developers) have come to be most strongly identified with the use of epidemiologically based, quantitative projections of mortality risk.

In a conventional HRA, an individual's health-related practices, habits, lifestyle, personal characteristics, and personal and family medical history are compared with data from epidemiologic studies and vital statistics in an attempt to project the individual's risk of death over some future period. Presentation of the risk projections is meant to encourage the client to regard them as specific to him or her as an individual. The projections are often expressed in terms of an "appraisal age" ("health age" or "physiological age"), which is compared, favorably or unfavorably, with the individual's chronological age. Recommended changes in health-related behaviors are then used to make projections of "achievable risk" and "achievable age" [2-5].

Several investigators have reviewed concerns about the statistical and epidemiologic basis of the risk projections from HRA [5-9] and about the accuracy of the client data [5, 10, 11]. Many of these con-

cerns could be remedied if the technique's effectiveness—in particular, its risk-projection basis—was sufficient to justify the necessary investment. In 1981, we reviewed existing evidence for the technique's efficacy and effectiveness [2, 3, 12]. In addition to critically reviewing the literature, we conducted site visits at 15 organizations that were using HRA (reports on each of the 15 site visits can be found in Beery et al. [3, Appendix E]). This article reviews several major studies that have appeared since our earlier report and one other review [11].

For purposes of this review, HRA is defined as a procedure for using epidemiologic and vital statistics data to provide individuals with projections of their personalized mortality risk and with recommendations for reducing that risk, for the purpose of promoting desirable changes in health behavior. Assessment procedures which do not calculate actual mortality risk are more varied and avoid many of the difficulties inherent in conventional HRAs. But projected mortality risks are the hallmark of HRA, and many believe them to be fundamental to its popularity and impact. An important question, discussed further on, is whether benefits gained from using HRA can be obtained from assessment procedures that provide feedback in terms of qualitative statements, or relative risk rather than absolute risk.

The major targets of HRA's use appear to be

1. Recruitment
2. Information
3. Motivation
4. Screening
5. Clinical counseling
6. Planning
7. Program evaluation.

Since most studies deal with changes in health-related behavior, this review will focus on studies concerning the effectiveness of HHA/HRA in promoting favorable changes in this area. Other uses will be discussed afterward.

There are numerous reports of favorable health-related behavior changes in persons who have participated in HRA programs. But nearly all of these studies (see critical reviews in [2, 11, 13]) used self-selected volunteers, encountered high rates of attrition, and failed to include a control group. Although suggestive, these studies cannot provide hard evidence, because they cannot separate the influences of volunteerism (persons joining health promotion programs often do so

from a desire to make changes in their lives); regression to the mean (persons selected due to their being at above-average risk will, on the average, be found to have lower risk at the next measurement); and secular change (there is a great deal of information and other influences promoting change toward more healthful behaviors) from the effects of HRA. Significant improvements in health-related behaviors and characteristics are frequently observed among subjects not participating in an explicit risk-reduction program [14, 15]. Therefore, only studies which included a comparison group and in which treatment was allocated without apparent bias are reviewed here. Another category of studies not included here are those that evaluate the effects of health promotion programs, with or without HRA, but do not include a non-HRA comparison group. Although these studies can show benefits from health promotion programs involving HRA, their design does not permit inferences about *whether or not HRA itself contributes* to differences in outcomes.

## REVIEW OF EVIDENCE

Five controlled studies have been reported, though not all in scientific journals. The study designs employed reflect the observations from the uncontrolled studies (see above) in which HRA by itself appeared to be capable of stimulating behavioral change. Thus, all of the studies used some variant of an incremental design in which HRA by itself and HRA plus counseling or education are compared with an untreated comparison group. In fact, it appears that standard use of HRA currently includes some form of follow-up counseling session, on an individual or group basis, along with referral to programs for making behavioral changes. One of the most sophisticated studies (Well Aware About Health) has not yet released its final report. Although the Well Aware study employed a factorial design, neither it nor any other study appears to have compared HRA in combination with health promotion interventions to those health promotion interventions with a similarly comprehensive assessment and feedback not containing projections of absolute risk (see Table 1).

In the earliest controlled study of behavior change, Hancock et al. [16] tested the impact of HRA by itself among 120 office workers (volunteers) at an industrial plant and randomly assigned them to receive:

1. Appraisal and results sessions at baseline and after six months (Group A)
2. Appraisal and results session at baseline (Group B)
3. Appraisal only (no results session) at baseline (control group).

All three groups had a follow-up appraisal and results session at one year. Attrition was low, and the groups were comparable demographically.

The principal index of change computed was the ratio of an individual's appraised risk to the average risk for someone of the same age and sex. The findings provide little evidence that HRA itself is responsible for improving health-related behavior. For example, persons in the control group and in Group A attained an almost identical reduction in their ratios of appraised risk to average risk, while persons in Group B had an *increase* in their ratio of appraised to average risk. There was no apparent correlation between lifestyle factors and risk ratio change, sociodemographic variables did not appear to have a major influence on risk ratio change, and one-quarter of the control group reported that the knowledge that they were participating in the study influenced their behavior. The relatively long follow-up period allowed time for recidivism, possibly contributing to the failure to observe a positive effect.

Lauzon [17] studied the ability of HRA to stimulate risk-reduction behavior among 293 English-speaking and French-speaking Canadian federal civil servants who visited occupational health units. The study employed an incomplete factorial design with categories for sex, age (30–40 and 41–55), and risk (“high-risk” subjects had at least one of the following HRA risk characteristics: excessive alcohol use, insufficient exercise, smoking) and three treatments:

1. Attention control, in which subjects completed the HRA questionnaire, had their blood pressure measured, and received health education pamphlets but no HRA feedback
2. HRA only, in which subjects received the health education pamphlets plus computerized feedback with both written and verbal explanations, but no counseling, guidance, or referrals
3. HRA plus counseling, in which, in addition to the items in the HRA-only treatment, subjects received detailed information about moderating personal health risks. Occupational Health Unit nurses were to elicit a commitment from each subject to modify his/her behavior. (Only the “high-risk” subjects were considered for this treatment.)

Table 1: Controlled Studies of HRA Effects on Behavior

<i>Authors</i>	<i>Study Population</i>	<i>Follow-up Period</i>	<i>Attrition (%)</i>	<i>Design</i>	<i>Results</i>	<i>Comments</i>
Hancock et al., 1977 [16]	120	12 months	4	Individual randomization A. HRA at baseline and 6 months B. HRA at baseline C. Control (HRA without feedback)	Equal risk reduction in Groups A and C Risk increase in Group B Mostly men	No Cointervention Statistical power?
Launzon, 1977 [17]	346	3 months	15	Individual randomization A. HRA + counseling B. HRA + pamphlets C. Control	Improvements in alcohol use, blood pressure, weight, exercise, breast exam, appraised age	Questionable analysis; uncertain interpretation
Smith et al., 1985 [18]	410	6 months	30	Individual randomization A. HRA, mailed feedback, invited to counseling B. No HRA results	Only 20 percent attended counseling Less weight gain, lower cholesterol, more seat-belt use No change in appraised age	No significant differences

*Continued*

<i>Authors</i>	<i>Study Population</i>	<i>Follow-up Period</i>	<i>Attrition (%)</i>	<i>Design</i>	<i>Results</i>	<i>Comments</i>
Blue Cross and Blue Shield of Michigan, 1983 [19]	1,449	2 years	21 28 29 19	Quasiexperimental/ randomized A. HRA, screening, counseling B. HRA, screening C. HRA D. Control	Group A had better lipid profile, weight loss, and absenteeism	Group A differed Complex data set Not published in scientific literature
Spilman, et al., 1986 [20]	3,528	12 months	38 30 74	Quasiexperimental A. HRA, health education B. HRA C. Control	Group A improvements in cholesterol, body weight, blood pressure, Type A	Selective attrition Local factors important
Dunton, 1985 [21]	1,683	2 years	40 35 40 39	Randomized, factorial A. HRA, health education B. HRA C. Standard assessment, health education D. Standard assessment	HRA improved knowledge, awareness, attitudes, seatbelt use, diet, anxiety, depression	Complex data set Final report not yet publicly available nor peer reviewed

Treatment allocation was sequential, with a different order of treatments within each age-sex-risk group. The order within each group was predetermined from a table of random numbers, but in most cases the occupational health nurse would have known the treatment assignment of the next qualified subject. Of 380 subjects recruited, 34 were eliminated due to errors in determination of eligibility, in classification according to the factorial structure, or in study procedure, and 53 additional subjects were not available for the posttest phase, three months later.

The HRA questionnaire used was pretested for test-retest reliability with a group of Canadian civil servants. Appraised age was highly stable ( $r = 0.94$ ) over the two-week interval in 26 subjects who returned usable questionnaires. In the actual study, however, 115 coding irregularities in HRA items were found comparing pretest responses. The bulk were apparently related to inconsistent recall of smoking history or of having obtained a rectal exam or Pap smear; errors in reporting height, weight, exercise, smoking, and other items were also noted.

Lauzon concluded that HRA stimulated significant beneficial changes in alcohol habits, diastolic blood pressure, weight, exercise habits or fitness rating, breast self-examination, and appraised age. The HRA plus counseling group reported greater changes in alcohol habits, breast self-examination, and appraised age than did the HRA-only group. Favorable changes occurred with other variables (blood pressure, rectal examination, and Pap smear), but there was little opportunity to detect significant improvement due either to the high initial prevalence of desirable behaviors or to control group improvements that matched or even exceeded those in the treatment groups. Anxiety, measured by the State-Trait Anxiety Inventory, showed no significant increase in any group. Both males and females reported that the HRA experience had stimulated them to change their personal health behaviors.

Several aspects of Lauzon's study's methodology and interpretation are problematic: the expectation of a social desirability influence on the self-reported outcomes; the large number of inconsistent or erroneous HRA item responses; the many opportunities for the project staff unconsciously to influence the outcome; and the fact that a multiplicity of outcomes was examined, each within eight age-sex-risk subgroups, with any unadjusted  $P$ -value under .05 being labeled "significant." There was no outcome measure on which either treatment group improved more than the control group within all of the sex-age-risk categories, and there were few consistent patterns of treatment-related

improvement. It is possible that different subjects, hence different groups, responded to HRA with improvements in different behaviors, but such a complex hypothesis would need to be tested in a more powerful study. The analysis of changes in appraised age showed better performance for the HRA groups in five of eight sex-age-risk strata, with an equivocal performance in another. Among the younger subjects, however, the HRA-only group did worse than both other groups.

Smith, Ekdahl, and Henley [18] reported a randomized clinical trial among adult outpatients attending an Army Medical Center family practice program during the first half of 1982. Four hundred ten patients completed an HRA questionnaire, signed a consent statement, and were randomly assigned to receive either a simple problem list plus mailed HRA printouts (based on Health Hazard Appraisal as described by Hall and Zwemer [4]) or only a problem list. Each patient was then invited to attend a family orientation session with his or her newly assigned family physician. The physician was provided with a copy of the analysis given to the patient as well as pamphlets for distribution. Follow-up HRA questionnaires were mailed six months later. Two hundred eight-eight patients were retested out of the 410 patients initially entered into the trial. Of these 288 subjects, 20 percent reported having attended a counseling session, with no difference between experimental and control subjects. Although the experimental group reported somewhat less weight gain, a lower mean serum cholesterol level, and a somewhat greater increase in seat belt use than the control group, none of the differences was statistically significant. There was little change in appraised age in either group.

Blue Cross and Blue Shield of Michigan (BCBSM) employed HRA as part of a comprehensive worksite health promotion research project called "Go to Health" [19]. The two-and-a-half-year project employed a quasiexperimental design with three experimental groups and an untreated control. The most intensively treated group (A) received a General Health Corporation HRA, biomedical screening, group sessions to review the results of the HRA, appointments for individual counseling for persons at elevated risk on one or more factors, and risk-reduction programs. Group B received the HRA, screening, and group interpretation sessions. Group C received the HRA with mailed feedback but no in-person interpretation. These interventions were offered during each of two years. Group D received no interventions. All of the subjects completed a questionnaire at baseline, one year, and two years, and granted access to their records on productivity and health insurance utilization.

Following a promotional period, questionnaires were mailed to

homes of 5,417 employees, with two follow-up mailings to nonrespondents. Questionnaires and consent/authorization cards were received from 1,886 employees. After exclusions for having less than six months employment at BCBSM before December 31, 1979, or for a history of a variety of cancers or cardiovascular diseases, 1,449 participants remained in the study. Group assignment was based on a combination of workplace and other factors. Eligible employees in one building of two Detroit office buildings were designated experimental group A. Subjects for groups B, C, and D were drawn from the other office building, with assignment by a random procedure that matched on as many as possible of the following factors: age, sex, race, and job classification. Because of differences in the workforce between the two buildings, subjects in Group A were older and more likely to be male, managerial, married, college educated, and nonminority. These differences were controlled for in intergroup comparisons. Dropout rates from the study were substantial and varied across groups (21, 28, 29, and 19 percent in Groups A, B, C, and D, respectively).

Outcomes were evaluated in four categories: (1) productivity (employee evaluation, absenteeism, and long-term disability); (2) health insurance utilization (hospitalization, professional, extended coverage, and drug prescription); (3) risk factors and risk (serum cholesterol, blood pressure, weight, high-density lipoprotein levels, blood glucose, smoking, weight, alcohol consumption, personality traits, physical activity, and general well-being, and HRA-derived cardiovascular disease risk, cancer risk, and total mortality risk); and (4) health attitudes and knowledge (beliefs concerning susceptibility to and severity of disease, difficulty and regularity in performing health activities, knowledge of disease and risk indicators, ability to modify health behavior, and efficacy of individual and physician actions to prevent disease). Since the risk factors and measures were obtained from the HRA or the screening, many were not available from Group D (and in some cases, from Group C).

The proportion of cigarette smokers decreased in all groups; the decrease was significant in Groups A and D. Quit rates were 27, 17, 19, and 17 percent in Groups A, B, C, and D, respectively. Mean blood pressure in Group A dropped significantly between 1979 and 1980, but was at its original level in 1981. In Group B, the only other group with blood pressure data, blood pressure increased from 1979 to 1980, but then dropped back again by 1981. All groups experienced decreases in weight as a percentage of desirable body weight. This decrease was sustained only in Group A. Both Groups A and B had significant improvements in blood lipid profiles (high-density lipopro-

tein (HDL) and cholesterol/HDL ratio), with the improvement in Group A continuing across both years of follow-up.

Interpretation of these results is complicated by the substantial attrition, the different source population from which Group A was recruited, and the fact that many of the key measures (blood lipids, blood pressure) were not available for all of the groups. Overall, however, the results do support the authors' conclusion that Group A changed the most and more often toward improvements in risk indicators. Group A had the greatest reduction in short-term absenteeism and the smallest increase in long-term absenteeism. Group A was the only group to end the study with lower projected cardiovascular disease risk. There is no evidence, however, that HRA was responsible for any of the observed changes in risk. The only comparison that directly addressed the effect of HRA itself, that between Groups C and D, yielded no significant differences. That comparison, however, was severely constrained by the limited data available for Group D.

Most recently, Spilman et al. [20] reported the results of an evaluation of a comprehensive health promotion program, the Total Life Concept, conducted at AT&T Communications in 1983 and 1984. The program consisted of General Health Corporation's HRA plus health education modules on fitness, backache, weight control, stress management, smoking cessation, cholesterol reduction, cancer screening, nutrition, and interpersonal communication. A quasiexperimental design compared three groups that received, respectively:

1. HRA and health education, in which employees received HRA feedback and were offered health education modules
2. HRA only, in which employees received HRA feedback but were not offered modules
3. Attention control, in which subjects were neither given HRA nor offered modules.

Group 1 consisted of participating employees from two AT&T locations (Kansas City, Missouri and Bedminster, New Jersey). Of 1,623 employees invited to participate, 1,198 (74 percent) completed the baseline HRA including biometric testing; 745 (62 percent of 1,198) completed the follow-up HRA one year later. Group 2 drew from randomly selected employees from five locations representing the regional diversity of AT&T (Morris Plains, New Jersey; Atlanta; San Francisco; White Plains, New York; and Oakton, Virginia). Of 1,673 invited to participate, 905 (54 percent) completed the baseline HRA; 634 (70 percent of 905) completed the follow-up HRA. Group 3 con-

sisted of randomly selected employees from Chicago and New York City. These employees were not offered a baseline HRA. Of 1,425 employees selected for this group, only 374 (26 percent) completed the follow-up HRA. The authors suggest that the much lower response rate in Group 3 may have been due to different demographic patterns in this group.

Study data came from HRAs administered at baseline and one year, together with biometric measures and a job- and health-related attitudinal survey developed for the study. Only posttest data were available for Group 3. Analysis of covariance controlling for pretest differences in age, sex, and management status showed significantly greater improvements in Group 1 than in Group 2 for diastolic blood pressure, serum cholesterol, Type A behavior pattern, and body weight. None of these differences was observed for both Kansas City and Bedminster worksites, and no overall analyses are presented. Based on the *P*-values (the only statistic presented for these differences), it appears that all of these differences are likely to reflect real changes, with the possible exception of Type A behavior. The differences between study group sites are marked, however, making it difficult to judge whether local factors could be more important than the treatment itself. There were small decreases in the percentages of smokers at the two Group 1 locations. Given the marked differences in demographic makeup and the unavailability of a preprogram measurement, Group 3 did not permit the issue of independent effects of HRA to be addressed.

The 38 percent and 30 percent dropout rates from Groups 1 and 2, respectively, raise serious concerns about selection bias. The report states that dropouts were different from subjects who completed the follow-up HRA.

Well Aware About Health [21-23] studied HRA, health education, and HRA plus health education in a randomized trial with an incomplete factorial design among patients enrolled in either a Tucson, Arizona health maintenance organization or a Tucson fee-for-service group practice. All subjects completed an attractive questionnaire; gave urine and blood specimens; and had their height, weight, blood pressure, physical fitness, and resting pulse measured. Subjects in the "standard medical assessment" condition received the results of these measurements along with explanatory information but no feedback on behavioral risks. In cases where seriously elevated values were observed, a medical referral was made. Subjects in the HRA condition received the results of the physical and laboratory measurements and also results of the Well Aware About Health HRA and the opportunity

for a personal counseling session. The HRA report included considerable semiquantitative and narrative feedback. Randomly selected subjects who were at elevated risk (whether in the "standard assessment" or HRA conditions) were, in addition, invited to attend health education classes. Trial outcomes studied included health knowledge, beliefs, and attitudes; health care utilization; health status; and health-related behavior.

About 10,000 patients at each of the two sites were randomly selected from medical records and were sent letters inviting their participation in the study. In response to this mailing, 1,683 persons aged 25 through 55, who met other eligibility criteria, completed the baseline assessment and received their results. Of these enrolled subjects, 1,042 subjects (62 percent) completed all follow-up examinations and results sessions. Substudies were conducted to determine characteristics of nonparticipants and dropouts. In comparison to subjects who missed one or more follow-up sessions, subjects who attended all visits were older and had more favorable values for self-reported current health status, smoking status, seat belt use, depression, alcohol intake, percent overweight, and projected risk. Proportionally more high-risk subjects were lost from the groups receiving HRA, although the differences across groups were not dramatic. In terms of marital status, education, income, and study site, attrition was approximately uniform across treatment groups.

Although results have not yet been published, the findings have been characterized as showing that the HRA intervention was associated with a significant narrowing of the gap between risk age and achievable age as well as with improvements in awareness of the importance of regular cervical and breast examinations and in health attitudes (feelings of control, responsibility, and ability to cope), although these changes were less persistent for subjects who did not avail themselves of counseling or education. Subjects in the HRA-only group reported increased seat belt use and improved dietary practices (notably reduced fat intake) overall or in low-risk subjects [24]. Subjects in the HRA-only group also had declines in reported depression and anxiety at each follow-up measurement.

This study has generated a wealth of information about the effects of HRA on attitudes and behavior. Although substantial attrition occurred, the data from follow-up visits and the dropout substudy provide some ability to assess the impact of the loss to follow-up. The very richness of the data set, however, presents formidable challenges in analysis and interpretation. It is to be hoped that adequate resources

can be assembled for further analysis and reporting of the results of this trial.

#### PREBEHAVIORAL OUTCOMES

If HRA does produce changes in health-related behaviors, then it should be possible to observe changes in factors that mediate behavioral change. Health Belief Model factors have been studied most. Cioffi [25] found no effect of HRA feedback, with or without counseling, on perceptions of susceptibility to disease or efficacy of prevention. The study was small, however, and had numerous measurement problems. The Spilman et al. study [20] found no significant change on belief in the ability to affect one's own health. A quasiexperimental study by Faust et al. [26] compared three HRA groups (General Health, Medical Datamation, and Centers for Disease Control) to a control group and found no uniform change in perceived susceptibility to major disease or in knowledge of risk factors. Increases in the perceived efficacy of actions that can be taken to prevent heart attacks were observed for exercise and weight control. The Blue Cross and Blue Shield of Michigan study found no significant differences in health beliefs or health knowledge [19, pp. 64, 85, 87]. An increase in belief in individual efficacy in preventing disease was observed, however, with the greatest increase in the most intensively treated group and intermediate increases in the two groups that received HRA but not risk-reduction classes [19, pp. 72-73]. The Well Aware study found HRA-related increases in awareness of need to increase seat belt use, reduce alcohol intake, and reduce cholesterol level. Although the data are not compelling, there do appear to be increases in perceptions that could support behavior change.

#### DISCUSSION

During the last several years, major studies using HRA, including large randomized trials, have been completed. Unfortunately, these studies do not provide clear evidence to establish whether HRA is or is not effective in stimulating behavior change. The Hancock et al. study [16], which found no advantage for HRA, was small and would have had limited statistical power to detect a benefit from HRA. It also did not offer health education or counseling along with the HRA. The Lauzon study [17] had methodologic and analytic weaknesses (the loss of 15 percent of eligible subjects, the short follow-up period, some lack

of rigor in data collection, and the absence of overall statistical tests) that introduce substantial uncertainties into the conclusions drawn by Lauzon. Although appraised age improved in five of eight strata and worsened in only two strata, the use of appraised age as an outcome measure is problematic [5, 27]. The Smith, Ekdahl, and Henley study [18], which found no difference between HRA and control groups, had a relatively small study population, experienced substantial attrition, and had other methodological shortcomings. The Michigan Blue Cross and Blue Shield study [19], though one of the largest and most comprehensive studies to date, had dropout rates in excess of 25 percent and lacked a clear test of HRA itself. The Spilman et al. study [20] experienced similar attrition and could not provide a real test of HRA given the problems with the control group. With its sophisticated design and protocol, the Well Aware About Health trial [21–24] will add substantially to knowledge about the use of HRA when the results become generally available. HRA appears to have produced improvements in seat belt use, diet, and anxiety and depression, although the impact of attrition needs further investigation. Even this trial, however, does not provide a direct test of the impact of the mortality risk projections that are the key ingredient in HRA, since the “standard assessment” condition did not receive feedback on health behaviors and the HRA condition involved considerable semiquantitative and narrative feedback. Thus, definitive evidence about the impact of HRA or of its absolute risk projections remains elusive.

Rigorous evaluation of the effect of a health education procedure on behavior change is a difficult undertaking, even more so for HRA given the diversity of contexts in which the procedure is used. Since a single educational intervention is unlikely to result in meaningful behavior change by itself [28], a more comprehensive program must usually be employed. But then it becomes difficult to distinguish the effect of HRA from that of the rest of the program. Furthermore, in contrast to a physiological intervention, where the placebo effect (i.e., the nonspecific effect of treatment per se) must be eliminated to prevent interference with the evaluation, in an educational/behavioral intervention such as HRA, a placebo effect may be a part of the outcome being sought [29]. There may be no way to separate the placebo effect from the HRA effect, or to employ a double-blind design.

Behavioral interventions are also highly influenced by the client's personality, attitudes, and level of previous knowledge. Whereas differences in personality are effectively balanced through randomization, attitudes and level of previous knowledge change over time in such a

way that a health education intervention may be effective at one time or in one population and not in another [29], or in respect to some behaviors (e.g., seat belt use or diet) but not others (e.g., smoking cessation or weight reduction). Randomization can avoid bias from differences in attitudes and knowledge, but it cannot ensure that the study population is suitable for testing the procedure. It may well be that, during the first years of HRA's use, it had substantial effects due to the much lower diffusion of awareness of risk and risk reduction, and to the lower incidence of physician counseling of patients about risk. Hall and Zwemer [4] give a graphic portrait of HRA feedback conveying a "sense of immediacy and urgency bordering on a health crisis . . . ." Of course, in such a situation some other procedure might also have been effective but evidently no other technique has drawn such a wide and committed following. In any case, it will be harder to demonstrate positive effects from HRA now that health promotion and wellness have had widespread dissemination and "early adopters" [29] have already changed their behavior. It is also exceedingly difficult, given ethical considerations and the plethora of attention to health behavior change, to avoid the erosion of apparent treatment differences due to changes in the control group [15]. Several of the studies of HRA reviewed above observed favorable changes in their control groups.

In view of the difficulties and cost of rigorous testing of the effectiveness of HRA, how essential is definitive evidence that HRA-based programs lead to improvements in health-related behavior? In particular, how essential is it to obtain clear evidence of the impact of HRA itself and specifically of its mortality risk projections? Arguments in favor of devoting major effort to definitive assessment derive from the substantial investment of resources in HRA, the very large number of persons exposed to the procedure, the considerable part that the federal government has played in refinement and dissemination, and the analogy to requirements for efficacy testing of drugs and medical procedures. On the other hand, HRA is a health education procedure, not a medical one. Definitive evidence of effectiveness is not customarily sought for health education procedures, and, given the special difficulties encountered in evaluating health education interventions, customary practice may be well founded. Indeed, if the most appropriate objective for HRA is the transmission of information in a personalized, relevant manner or stimulation of client participation in health promotion programs, evaluation of effects on behavior change may be off the mark. Most of the expenditures on HRA are being made by private organizations, which typically do not require the degree of evidence

needed for public health decision making. Because available data support the conclusion that health promotion programs with HRA have positive effects, assessing the specific role of HRA may be a secondary issue. If HRA appeals to program staff and involves no harm to clients, how much does it matter that the program might be just as effective without HRA?

Even if a definitive assessment of HRA's overall impact is not judged essential, there remains the scientific and practical question of whether to retain projections of absolute mortality risk. These projections have limitations in several regards. The risks presented in HRA are mostly numerically small, so that they must be stated "per 100,000" rather than the more familiar "percent." The possibility of death at some indeterminate time in the future may be too abstract or too frustrating a consideration for most people to respond to effectively. Interpretation of statements about risk is greatly influenced by an individual's conception of the acts, outcomes, and contingencies associated with the available choices [30]. HRA seeks to surmount these problems through the projections of life expectancy, risk age, and achievable age [31]. The translation of small risks into risk ages, however, can still produce a weak message (e.g., "if you adhere to an exercise program as prescribed by your doctor, your risk of dying from heart disease will be reduced and you will extend your useful life expectancy by 0.1 years"). Also, the meanings attached to age vary considerably, especially for younger persons who associate age with maturity.

Inclusion of morbidity risks would alleviate some of these limitations, but health is only one basis for behavioral choices, and arguably not a primary one [32-34]. Appeals to vanity, promises of success in love or business, and the like may be much more effective for motivating health-related behaviors [35]. Fear can indeed be an effective motivator, but it is a complex, even treacherous, one that raises both practical and ethical problems [34, 36]. The overall impact of fear as a motivation for lifestyle behaviors that must be continued indefinitely, rather than for behaviors that need be performed only once, may be detrimental [35].

In view of the foregoing, a research program aimed at assessing the importance of including projections of absolute risk may be a more fruitful strategy than attempts at a definitive test of whether HRA does or does not increase behavior change. The uncertain validity of these mortality risk projections has been the subject of several reviews and considerable public and private investments of money and effort. If the mortality risk projections do not make a

significant contribution to the beneficial effects of HRA, many concerns about HRA can be avoided by using a procedure that does not present risk projections to the client.

#### OTHER HRA OUTCOMES

HRA outcomes other than changes in health behavior are important to consider. The programs we visited often cited HRA's ability to stimulate interest and participation in their health promotion programs as the main reason for using the procedure, sometimes at considerable expense. The literature contains numerous reports of high participation in programs that use HRA (e.g., [20, 37, 38]). Johns [39], however, reported that only 15 percent of a random sample ( $N = 1,186$ ) of active patients at a multispecialty clinic among a predominantly Mormon population in northern Utah returned an Interhealth Corporation HRA that they were sent in the mail. Low participation rates were also common in the programs we visited. In the one study [18] that permits a comparison between subjects provided an HRA printout and equivalent subjects not provided HRA printouts, participation in counseling sessions was virtually identical. It is likely that here, as in health behavior change, HRA effects on participation depend heavily on situational and social factors, as well as on presentation (content, format, style, etc.) of HRA publicity, questionnaires, and feedback.

A major use of HRA that we observed, and one that may help to account for its popularity in health promotion programs, is the organization of health concepts and information around a coherent theme for presentation in a counseling session or in an introduction to a health promotion program. HRA provides in one "package" a rationale, a framework for presentation of health information, an exercise that engages the client, and personalized feedback which serves both as a "gift" from the counselor and a printed summary of the information to improve client recall. Lauzon [17] has suggested that HRA facilitates the discussion of potentially emotional or embarrassing issues by providing the context of a general health behavior assessment. Milsum [40] suggests that HRA's primary importance is in creating "a 'teachable moment' when a health professional as counselor and a patient as client come together to discuss comprehensively the person's health condition and the risks to which he is exposing himself . . . ." A family practice residency training program which for many years has used HRA as part of the entrance medical examination for new patients told us that HRA serves as a reminder to the physician to focus on risk

factors. In the practice's experience, maintaining that focus consistently is difficult for physicians, even for those specifically oriented toward preventive medicine [3, Appendix E].

HRA was developed for use by private physicians in their office practices, as a means of reorienting the emphasis from disease and treatment to health and prevention. The early versions, with hand computation, invited physicians to alter the ingredients of the appraisal as they felt appropriate. There was no pretension of scientific accuracy (as opposed to the "best knowledge available") nor was there a computerized "aura of authority." In the wave of enthusiasm for health promotion and disease prevention, many programs have seized on the procedure as having a strong influence of its own. However, the vast majority of HRAs take place in connection with employer- or university-based health promotion programs, which are typically unrelated to the client's ongoing medical care relationships.

It has been suggested that a personal counseling approach to changing lifestyle behaviors is most effective in the context of an ongoing care relationship, such as the doctor-patient one. In such a context, the patient has entrusted him- or herself to the provider who, in turn, has accepted that responsibility and has made a commitment to assist the patient in improving or maintaining the patient's health. The patient is available and has indicated a receptiveness to recommendations from the clinician. This relationship can support behavioral recommendations; accommodate sensitive, anxiety-provoking topics; and provide for monitoring over time better than can a transient interaction with health promotion program staff. Furthermore, the impersonal setting can create a sponsor's tendency to use HRA as an external authority to buttress the program's image at the expense of full cognizance or candidness about the limitations in scientific knowledge concerning risk reduction and risk projections.

The overall public health effectiveness of screening and health education programs as a strategy of personal risk factor modification has also been questioned [41, 42]. Deployed on a population basis, such a strategy raises health service delivery issues, including the logistical demands of screening and treating large numbers of persons, difficulty in achieving effective follow-up of positives, medical and related costs of false positive tests, and the burden on the health care system (see [43]). Although the personalized health risk appraisal-risk reduction approach is often presented as analogous to screening for early detection and treatment of cancer, there are important differences:

1. The target conditions "detected" by HRA are associated with moderate elevations in risk; those detected by cancer screening are early stages of fatal illness.
2. Behavioral risk factors, unlike occult cancer, are in many cases observable without medical technology.
3. The effectiveness of existing interventions to reduce risk is problematic; cancer screening is appropriate only when effective treatments exist.

The mass screening approach to smoking cessation, dietary change, and exercise promotion may be justified as a strategy for promoting community behavioral change, but it does not meet accepted criteria for conventional screening programs.

What can be concluded based on the evidence currently available? First, HRA is probably more suitable for use with middle-aged than with younger or older individuals [9, 11]. HRA provides little statistical incentive to those under 40 to change poor health habits; the threat of dying in 40 years is remote. However, with persons over age 65 the risk factors themselves are not as good predictors [9]. In the teenage and young adult years, there are also anomalies in the performance of appraisal age [2, 3, 5] as well as serious questions about the message it conveys.

Second, individuals given HRA within a supportive educational process presumably gain more from the experience and make more beneficial changes than do individuals exposed only to the results of HRA [11]. The current view, which may reflect shifts in the experience of the target populations, is that HRA by itself is unlikely to have any significant impact on behavior. In fact, concerns have also been raised about providing HRA feedback without opportunities for discussion and clarification with a knowledgeable professional. Both the Society for Prospective Medicine and the Centers for Disease Control recommend that HRA programs provide for counseling and/or risk reduction programs.

Third, existing HRAs are probably not suitable for minority ethnic or blue-collar populations. In one pilot study [44], blue-collar employees could not understand many of the words in the Centers for Disease Control HRA, although many of the subjects answered the questions anyway. Even after engaging in a lengthy discussion of the concept of risk age with their subjects, the investigators remained uncertain whether the workers had any appreciation of the concept. The study recommended that risk age be eliminated from appraisals used with blue-collar populations. Similarly, HRA has been regarded

as having serious drawbacks for use with blacks due to the inadequacy of the epidemiologic data on risk factors in blacks (notably for death due to homicide); the fragmented nature of health care services available, especially for poor blacks; and the incongruence of the focus on individual behavior modification with the realities of living as a member of a minority group in a social-political system that restricts participation in decision making, economic gain, and educational opportunities, and a social environment where external threats to health, such as violence, are prominent [45].

Fourth, HRA—particularly appraisal age and other HRA-derived statistics—should not be used as primary measures of program effectiveness until their performance as measures has been more thoroughly evaluated [27].

The inadequate state of knowledge about HRA can be partly attributed to the fact that no federal agency has sponsored a systematic research program on the subject. Most of the studies have been carried out with minimal funding, by persons outside the mainstream of scientific research, and without benefit of external review. Most federal research funding has gone into development and refinement of appraisal methodology; no substantial investment has been made by either public or private organizations in developing a body of research data bearing on effectiveness. An appropriate and attractive strategy, given the present situation, would be to develop research programs in support of focused studies to determine the effects of absolute mortality risk feedback on knowledge, beliefs, attitudes, intentions, and program participation. Large-scale, randomized trials to establish effects of HRA mortality-risk feedback on health-related behavior could await the results of these studies and other developments in the field. All of these studies must achieve a greater degree of rigor and completeness of follow-up than have characterized most of them to date. These requirements have implications for funding and review procedures.

Some specific research questions to be investigated are:

1. How do clients perceive HRA? Our impression from the site visits is that many clients may not understand that a risk appraisal conducted in a screening setting (e.g., the worksite) is different from a physical examination by a doctor, and that client confusion is probably fostered by mixed messages given out by the program (such as saying that the appraisal is not a medical examination but including various biomedical screening tests that are not part of the risk prediction in order to make participation more attractive to potential clients).

2. How do clients interpret statements about risk in HRA? Do clients understand feedback about risk? Does quantitative presentation facilitate client understanding and ability to benefit from health information? Is a risk projection procedure that is less mathematically sophisticated and more intuitive (e.g., the credit-debit method) better in this respect than a more precise but mathematically more sophisticated method (e.g., multiple logistic regression)?
3. Does personal feedback of risk make a difference? Would HRA maintain its apparently considerable popular appeal if mortality risk projections and appraisal age were no longer given to the client? The risk and age projections appear to be primary attractions of HRA's "aura of intrigue." In this respect, the computerized assessment becomes a diagnostic instrument, the health educator's stethoscope or sphygmomanometer, revealing aspects of health not visible to the naked eye. On the other hand, recent HRA procedures, including the current version by Well Aware About Health, have downplayed or removed absolute-risk feedback because of its complexity.
4. Does incorporation of HRA into periodic medical examinations increase attention to appropriate health behavior counseling? Use of HRA in the context of a periodic medical examination brings several advantages (receptivity of the client, prompting of the clinician, knowledgeable interpretation of HRA feedback, and mediation of HRA recommendations).
5. Does elaborate (and expensive) packaging of the appraisal results improve understandability and impact?

The possibility of harmful effects should continue to be studied, particularly for older, younger, infirm, and minority clients.

Much of the recent work on HRA has gone toward assessing and improving the validity of HRA instruments. This is a complex issue, however, since beyond a basic level, accuracy or precision of *prediction* is not necessarily an important concern for HRA [2, 46]. A recent study at the American Institutes for Research (funded by the National Heart, Lung, and Blood Institute) [47] found that—at least for coronary heart disease—most HRAs provide reasonably accurate predictions. The second phase of that study will investigate comprehension of HRA input and output, test-retest reliability, and the impact of HRA

feedback on health care utilization in a representative sample of Boston area residents.

When HRA is used as a health education or counseling aid (for promotional, motivational, informational, or organizational purposes), two aspects of accuracy seem crucial. The first is that HRA deal with appropriate risk characteristics and produce appropriate recommendations for change. At present, there appears to be substantial variation across HRAs in the behavior change recommendations they generate. For example, Plumb [48] found differences in recommendations concerning breast self-examination, Pap smears, treatment for depression, alcohol use, rectal examination, weight loss and drug abuse. The second is that HRA not imply greater quantitative accuracy and precision than are available from existing data. An instrument that yields an arbitrary scale score and employs crude measures for risk characteristics rather than precise measurements may yield highly inaccurate risk predictions. But because the instrument does not purport to be particularly accurate or precise, this inaccuracy may be less objectionable than that for an instrument that achieves greater accuracy and precision but in doing so implies a higher level of these qualities than it in fact attains. HRA's apparent precision is deceiving [9, p. 34].

Among the more promising avenues for further development and refinement of HRA are:

1. Innovative modes of presentation and feedback to increase the impact of nonquantitative or semiquantitative HRA feedback. Interactive computer modes could permit considerable tailoring of client feedback, possibly enhancing impact.
2. Appraisals covering outcomes relevant for different life stages (e.g., elderly, youth), life circumstances (socioeconomic status, family constellation), and settings (clinical, worksite). Freed from the risk-projection framework, such appraisals could be flexible in incorporating behaviors and outcomes for which data exist. Interactive computer techniques could focus data collection on the areas most relevant for the particular client, making comprehensive appraisals more feasible.

There is also a continuing need for quality assurance in the development and use of HRA procedures. Total consistency across appraisal instruments is not practical, given differences among experts about risk factors and health promotion recommendations. Nevertheless, it is important that there be some means to reduce the inclusion of recom-

mentations that are grossly unsupported by evidence. Possible resources that could be helpful are a buyer's guide outlining specific aspects to examine in selecting an HRA and a set of reference norms, such as a published data set for which HRA vendors could be asked to provide their appraisal results. Both the Society for Prospective Medicine and the Centers for Disease Control have disseminated standards aimed at assuring appropriate use of HRA.

Appraisal procedures that provide systematic feedback about health practices and behaviors but avoid mortality risk projections may meet the apparent need for packaged health education procedures. Less reliance on quantitative feedback will circumvent many of the problems of conventional HRAs. Alternative ways to stimulate interest in health promotion need to be explored as a way of evading the apparent dilemma of HRA—that the client's interest comes from the belief that the appraisal will reveal his or her future, yet the knowledge base to support such an appraisal remains to be developed. Perhaps one of the greatest benefits from HRA is that it forces us “to make explicit what it is we know, how adequate that information is, and what it is that we do not yet know” and that it “sharpens our awareness of the areas where information is missing in biomedical and psychosocial knowledge” [11].

## CONCLUSION

HRA may be a useful tool for health education, but clear evidence of its impact remains to be seen, particularly in regard to the presentation of mortality risk projections. No study published to date provides a real test of HRA's effects on health-related behavior change. On the basis of evidence available at this time, use of the procedure appears most appropriate among middle-aged, middle-class clients in the context of an ongoing patient-provider health care relationship. The use of HRA as a mass screening device is problematic. Indeed, the mass screening approach to behavioral risk reduction needs to be justified on some basis other than those used for conventional disease screening programs.

To some extent, HRA is the victim of having been oversold, resulting in criticism of its inability to demonstrate achievements that were inappropriate to expect. The standard of evaluation needed for a health education procedure like HRA is not at all clear. An epidemiologically based HRA procedure that provides feedback in terms of qualitative statements or relative risk may be a promising alternative to

current varieties. Such a procedure preserves the major contribution of HRA's originators—the use of epidemiologic and medical data for systematic, prospective health assessment.

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